

Waste Water Energy

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Adapted Lesson Plan
Final

Subject: Mathematics

Grade: 7

Topic: Energy (Extension: Waste)

Goal: Students will use proportional reasoning to solve multistep ratio problems.

Description: Using the number of miles per gallon their car can travel, students will be able to use proportional reasoning to determine how far they can travel with a given amount of gas.

Common Core Standard:

Content Strands:

7RP.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{1/2}{1/4}$ miles per hour, equivalently 2 miles per hour.

7RP2 Recognize and represent proportional relationships between quantities.

- Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table.
- Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
- Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p , the relationship between the total cost and the number of items can be expressed as $t = pn$.

Standards for Teacher Competency:

3c Engage Students in Learning

Standards for Mathematical Practice:

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.6 Attend to precision.

Launch

Students will select a car for them to use its specifications during their task.

Explore

In pairs, students will complete the mpg task for their car.

Task:

You are planning to drive from New York to San Francisco in your car. Since the number of gallons of gas your car uses is proportional to number of miles you can drive, fill out the table below showing how far in miles you can travel for each gallon of gas you used. Then, write an equation that can be used to compute subsequent miles per gallons of gas and the total distance you will be able to travel in your car.

Summarize

Students will compare the miles per gallon that each car was able to go and the number of passengers the car can take to determine the most efficient car.

Extension

1. The information about the CO₂ emissions will be used to choose the most environmentally friendly option from the most mpg efficient cars.
2. Students can graph the mpg of their car and use the graphs to compare the efficiency of the cars.

Part A. Complete the ratio table.

Your Car

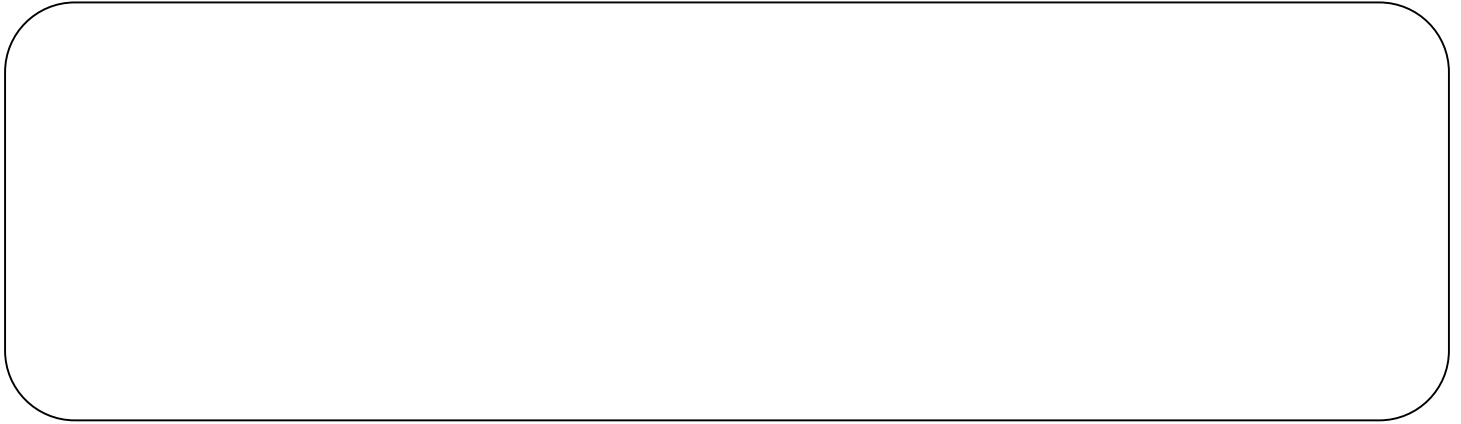
GALLONS	1	3		7	10	12
MILES			300			

Show your work.

Explain, in writing how you determined the missing values in the ratio table above.

Part B. Write an equation.

In the box below, write an equation that can be used to find the distance (d) you can drive on any number of gallons (g). Then, in words, explain what the equation means.



Explain in writing how you know.



Part C. How far can you travel?

If each passenger of your car has \$50 to spend on gas, and gas is \$5 per gallon, how far can you travel with the gas that is afforded to you?

Show your work.

Explain in writing how you know.

RUBRIC – Proportional Reasoning Task

	4	3	2	1
COMPLETING PROPORTION TABLE	<p>Student was able to utilize proportional reasoning processes to accurately fill in the table.</p> <p>Explanation is thorough, clear, complete and shows a strong understanding of proportional reasoning</p>	<p>Student was able to utilize proportional reasoning processes to accurately fill in most of the table.</p> <p>Explanation may contain incomplete, ambiguous or misrepresented ideas</p>	<p>Student was able to utilize proportional reasoning processes to accurately fill in some of the table.</p> <p>Explanation is based on misleading assumptions, and/or contains errors in its execution</p>	<p>Student was unable to utilize proportional reasoning processes to accurately fill in the table</p> <p>Explanation is incorrect, incomplete, or not based on work shown</p>
WRITING AN EQUATION	<p>Student was able to correctly write an equation relating the distance they can drive to the gallons of gas their car uses.</p> <p>Explanation is clear and relates to context of the problem.</p>	<p>Student was able to correctly write an equation relating the distance they can drive to the gallons of gas their car uses.</p> <p>Explanation may contain incomplete, ambiguous or misrepresented ideas</p>	<p>Student was able to correctly write an EXPRESSION, but not an equation relating the distance they can drive to the gallons of gas their car uses.</p> <p>Explanation was reasonable.</p>	<p>Student did not show evidence of mathematical understanding in their linear equation.</p>
SUBSEQUENT PROPORTIONS	<p>Student was able to correctly calculate the distance they can drive with the gallons of gas allotted to them. Solution is written in a complete sentence including appropriate units and relating to the context of the problem.</p>	<p>Student was able to correctly calculate the distance they can drive with the gallons of gas allotted to them. However, solution was missing appropriate units.</p>	<p>Student began an appropriate strategy to calculate the distance they can drive on a full tank of gas. However, was unable to correctly calculate the gallons of the gas they were allotted based on the passengers that fit in their car. Although solution is incorrect, student was able to clearly explain an appropriate procedure.</p>	<p>Student was not able to calculate the distance they can drive with the gallons of gas they were allotted.</p>

Car Selection

You drive a Toyota Prius Hybrid. It gets 46 mpg (46 steps) and carries 5 people.



You drive a Subaru Outback Wagon AWD. It gets 22 mpg (22 steps) and carries 5 people.



You drive a Toyota Yaris. It gets 31 mpg (31 steps) and carries 4 people.



You drive a Smart Fortwo Coupe. It gets 36 mpg (36 steps) and carries 2 people.



You drive a Dodge Viper. It gets 16 mpg (16 steps) and carries 2 people.



You drive a Hummer H3. It gets 16 mpg (16 steps) and carries 5 people.



You drive a Honda Civic. It gets 29 mpg (29 steps) and carries 4 people.



You drive a Honda Civic Hybrid. It gets 42 mpg (42 steps) and carries 4 people.



You drive a Scion xB. It gets 24 mpg (24 steps) and carries 5 people.



You drive a MINI Cooper. It gets 29 mpg (29 steps) and carries 4 people.



You drive a Porsche 911 GT2. It gets 19 mpg (19 steps) and carries 2 people.



You drive a Ford F150 4WD pickup. It gets 15 mpg (15 steps) and carries 4 people.



You drive a Ford Escape 4WD. It gets 21 mpg
(21 steps) and carries 5 people.



You drive a Ford Escape Hybrid 4WD. It gets 28 mpg
(28 steps) and carries 5 people.



You drive a Jeep Grand Cherokee 4WD. It gets 17 mpg
(17 steps) and carries 5 people.



You drive a Dodge Dakota 4WD Pickup. It gets 15mpg
(15 steps) and carries 3 people.



You drive a Honda Civic CNG (Compressed Natural Gas). It gets 28 mpg (28 steps) and carries 4 people.



You drive a City Bus. It gets 6 mpg (6 steps) and carries 40 people.



You drive a GMC Savana Van. It gets 14 mpg (14 steps) and carries 12 people.



You drive a Volkswagen New Beetle. It gets 23 mpg (23 steps) and carries 4 people.

